INVESTIGATOR'S ANNUAL REPORT

National Park Service

All or some of the information provided may be available to the public

Reporting Year: 2002	**Park:** Shenandoah NP
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Permit#:
SHEN-2002-SCI-0010

Park-assigned Study Id. #:
SHEN-00038

Project Title:
SHENANDOAH WATERSHED STUDY (SWAS)

Permit Start Date: Jan 01, 2002	**Permit Expiration Date** Dec 31, 2002
Study Start Date: Jan 01, 2002	**Study End Date** Dec 31, 2051

Study Status:
Continuing

Activity Type:
Research

Subject/Discipline:
Watershed Management / Assessment

Objectives:

The Shenandoah Watershed Study (SWAS) has both scientific and practical resource-management objectives. The underlying scientific objective of the SWAS program has been to improve understanding of hydro-biogeochemical processes and factors that govern ecosystem conditions in SNP's mountain watersheds. This scientific objective complements a resource management objective that has been defined by the need to document and assess change that is occurring in SNP's ecosystems.

Findings and Status:

Trends in the acid-base composition of Shenandoah NP stream waters:

Trend analysis for SWAS study streams (n = 14) has been updated for water years 1988-2001. Results will be reported in the document, Assessment of Air Quality and Related Values in Shenandoah National Park (Sullivan et al., in review). In summary, the patterns of annual trends in quarterly ANC and sulfate concentrations indicate that SNP streams are showing signs of recovery from acidification. Considered in relation to regional-scale analysis, these observations suggest that changes in SNP stream water composition may reflect a north-to-south recovery gradient in the eastern United States. It is notable that regional-scale recovery has not been observed among streams in the larger western Virginia region, which includes streams to the south of SNP. It should also be noted, however, that the changes in surface water acid-base constituents in SNP and the larger western Virginia region are small compared to those observed in more northerly regions. In addition, changes in SNP and western Virginia stream water composition may be related to other factors, including changes in stream water discharge and the effects of forest disturbance. Seasonal differences in trends have also been noted; for example, trends for the winter season are consistent with continued acidification, rather than recovery. This seasonal variation has biological significance, given that the more-sensitive life stages of many aquatic fauna are present in the winter season.

Base-cation status in Shenandoah NP forest soils, trees, and stream waters:

Initial efforts to examine linkages between the base status of forest soils, trees, and stream waters in SNP were completed. A preliminary report was presented at the annual meeting of the USDA Forest Health Monitoring Program (Webb et al., 2002). An analysis was conducted based on composition data for stream water samples obtained from 14 geologically stratified catchments in SNP over the period 1988-1999, 79 soil pits sampled from the same catchments in 2000, and samples of northern red oak bole wood obtained at 28 of the soil sample sites in 2000. The analysis indicates a clear gradient in base cation availability in the forest ecosystems of SNP. Areas underlain by basaltic bedrock have a greater capacity for export of base cations in stream water, have higher soils base saturations, and have higher bole wood content of the important nutrient cations Ca and Mg. Granitic areas are intermediate, and siliciclastic areas have the lowest base cation availability. The base cation patterns relative to bedrock lithology are similar for surface waters, soils, and bole wood of red oak trees. In particular, patterns of Ca and Mg in bole wood correspond with base cation availability in soils and base cation export in streams. This has not been demonstrated previously for southeastern forests. The siliciclastic landscape units have significantly lower availability of base cations in all components of the ecosystem. Because the reservoir of base cations is relatively low, this landscape unit is especially sensitive to loss of base cations. The implications of base cation loss for forest health and suitability of aquatic habitat are of particular concern for these areas.

For this study, were one or more specimens collected and removed from the park but not destroyed during analyses?

No

Funding provided this reporting year by NPS:	**Funding provided this reporting year by other sources:**
77155	0

Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college

Full name of college or university:	**Annual funding provided by NPS to university or college this reporting year:**
University of Virginia	77155